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IS 12402-2 (1988): Mobile containers for solid waste, Part 2 Methods of test [MED 7: Material Handling Systems and Equipment]



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*Indian Standard***SPECIFICATION FOR
MOBILE CONTAINERS FOR SOLID WASTE****PART 2 METHODS OF TEST**

1. Scope — Prescribes the methods of tests applicable to mobile containers described in IS : 12402 (Part 1)-1988 'Specification for mobile containers for solid waste : Part 1 General characteristics'.

2. General

2.1 Before the tests, it is necessary to carry out a visual inspection of the container for the purpose of:

- a) checking that the container is not damaged and has no visual defect, and
- b) making a comparison between the condition of the container before and after the tests.

2.1.1 It shall be ascertained that the manufacturing characteristics of the container to be tested shall be in accordance with IS : 12402 (Part 1)-1988.

2.2 Conditioning — The following three conditioning temperatures shall be applicable:

- a) $+ 20 \pm 5^{\circ}\text{C}$
- b) $- 18 \pm 3^{\circ}\text{C}$, minimum duration 12 h
- c) $+ 60 \pm 5^{\circ}\text{C}$, minimum duration 12 h

2.2.1 Conditioning at temperatures (a) or (b) above shall be carried out only when the container's constituent elements are particularly affected by heat or cold. In particular, containers made entirely of metal shall not be subjected to temperatures (b) and (c) above. On the other hand, containers made from plastic material (entirely, or in part) shall be subjected to temperature (b) and (c).

2.3 Characteristics of the Ballast Used for the Tests — Two types of ballasts, namely ballast No. 1 and ballast No. 2 are used for test on normal, 'N' type, and reinforced, 'R' type containers, respectively.

2.3.1 Ballast No. 1 for normal type containers — The density of ballast No. 1 is equal to the average density of the waste (0.2 kg/dm^3) multiplied by a safety factor of 2.

2.3.2 Ballast No. 2 for reinforced type containers — The density of ballast No. 2 is equal to 1 kg/dm^3 which corresponds to an average density of the waste contained in reinforced type containers (0.5 kg/dm^3) multiplied by a safety factor of 2.

2.3.3 Composition — Ballast shall consist of the following:

- a) Metal parts (long bolts, etc); and
- b) Rubber balls.

2.3.3.1 The respective quantities of rubber balls and metal parts shall depend on the type of container (normal or reinforced).

2.3.3.2 Ballast shall occupy 90 percent of the total capacity of the container.

Note — A type of ballast is necessary to obtain valid comparative results equally over a period of time on the same object as at the same time on different objects.

2.4 Test Load — The test loads of the containers in relation to their type and capacity shall be as given in Table 1.

Adopted 4 August 1988

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TABLE 1 TEST LOAD (kN)
(Clause 2.4)

Type	Capacity (litre)	Normal Type 'N'	Reinforced Type 'R'
Class A	120	0.48	1.2
	240	0.96	2.4
	330	1.32	3.3
Class B	500	2	5
	750	3	7.5
	1 000	4	10

3. Tests

3.0 The following tests shall be carried out according to the method prescribed and the sequence given below:

- a) *Test 1* — Check on maximum allowable deflection (3.1),
- b) *Test 2* — Determination of capacity full to the brim (3.2),
- c) *Test 3* — Traction (3.3),
- d) *Test 4* — Lifting when empty (3.4),
- e) *Test 5* — Impact on the walls (3.5),
- f) *Test 6* — Vibration (3.6),
- g) *Test 7* — Free fall (3.7),
- h) *Test 8* — Impact on inclined plane (3.8),
- j) *Test 9* — Effectiveness of braking device — four wheeled containers (3.9),
- k) *Test 10* — Strength of handles — two wheeled containers (3.10),
- m) *Test 11* — Lifting of the loaded container (3.11),
- n) *Test 12* — Stability (3.12),
- p) *Test 13* — Overcoming of obstacles (3.13),
- q) *Test 14* — Traction (towage) (3.14),
- r) *Test 15* — Salt mist (3.15),
- s) *Test 16* — Noise (3.16),
- t) *Test 17* — Inflammability of the constituent materials (3.17), and
- u) *Test 18* — Check of maximum allowable deflection (3.18).

3.1 *Test 1 — Check on Maximum Allowable Deflection*

3.1.0 General — This test shall be applicable to both Class A and Class B containers and shall be carried out on empty containers before and after the series of tests.

3.1.1 Procedure — Deflection measurement shall be made on overall width of the container and at the level of planes of access of gripping systems. The deformation permissible on gripping face is shown in Fig. 1.

3.1.1.1 Acceptance criteria — The maximum allowable deflection shall be 10/1 000.

3.2 *Test 2 — Determination of Capacity Full to the Brim*

3.2.1 *Procedure*

3.2.1.1 Place the empty container in a tank having sufficient capacity to receive the container.

3.2.1.2 The container shall not be inclined.

3.2.1.3 Fill the tank and the container simultaneously with water at a temperature of $15 \pm 5^\circ\text{C}$.

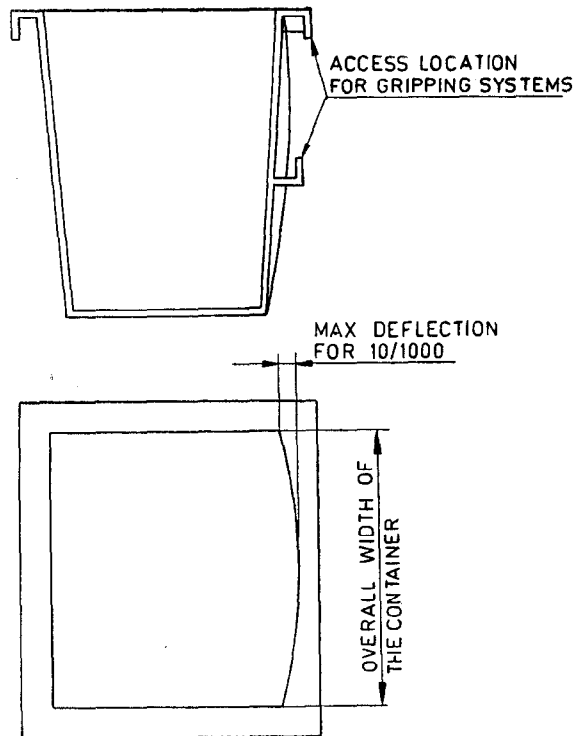


FIG. 1 DEFORMATION PERMISSIBLE ON GRIPPING FACE

3.2.1.4 Stop filling when the water level is 10 mm from the upper edge of the container.

3.2.1.5 Measure the quantity of water inside the container.

3.2.1.6 Accuracy of measurement shall be ± 1 percent of the measured capacity of the container.

3.3 Test 3 — Tensile Test

3.3.1 This test is applicable to Class B containers.

3.3.2 The test is carried out before and after the mechanical strength tests.

3.3.3 The equipment used for this shall be as follows:

- a) Dynamometric ring, and
- b) Rolling surface.

3.3.3.1 The rolling surface shall be flat and horizontal and shall include irregularities not exceeding in height by:

- a) 5 percent of the wheel diameter for wheels fitted with a flexible rolling tyre (Shore A hardness ≤ 90); and
- b) 2.5 percent of the wheel diameter for wheels fitted with a hard rolling tyre (Shore A hardness > 90).

3.3.4 Procedure — The loaded container is pulled in a straight line on a rolling surface by means of a dynamometric ring in each of the following cases:

- a) With the wheels placed parallel to the direction of motion, and
- b) Carry out traction perpendicularly to the previous motion without changing the direction of the wheels (see Fig. 2).

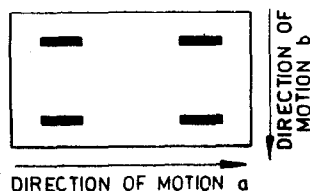


FIG. 2 DIRECTION OF MOTION

3.3.4.1 In each of the case **3.3.4(a)** and **(b)** above, the maximum tensile force shall be noted.

3.3.4.2 The test shall be repeated five times.

3.3.5 Acceptance criteria

3.3.5.1 The test shall be considered satisfactory if the increase in tensile force does not exceed 30 percent between a container in a new condition and a container which has been subjected to a mechanical strength test.

3.3.5.2 After the test, the container shall show neither permanent deformation nor abnormality making it unfit for use or having an influence on its later ageing process, and its dimensional characteristics regarding handling and interchangeability shall be respected.

3.4 Test 4 — Lifting Test

3.4.1 Equipment — Comprehensive gripping system used for this test is shown in Fig. 3.

3.4.2 The test shall be carried out on empty, open and closed containers.

3.4.3 The method consists of manoeuvring the empty containers successively on the lifting/tipping equipment shown in Fig. 3.

3.4.4 Acceptance criteria — After the test, the container shall show neither permanent deformation nor abnormality making it unfit for use or having an influence on its later ageing process, and its dimensional characteristics regarding handling and interchangeability shall be respected.

Note — If the container does not give satisfactory results after the lifting test, the other tests shall not be carried out.

3.5 Test 5 — Impact Test on the Walls (Container and Lid)

3.5.1 This test shall be carried out on empty containers.

3.5.2 Equipment — The equipment used for this test shall be as follows:

- a) A jib for free fall, and
- b) A metal ball with a weight of 7 kg and 125 mm in diameter.

3.5.3 Procedure

3.5.3.1 Test of the container

3.5.3.1.1 Containers made from plastic material shall be subjected to a previous test at a temperature of -18°C for 12 h.

3.5.3.1.2 The test shall be carried out within the conditioning area. In case this is not possible the test shall be carried out within five minutes following the removal of the container from the conditioning area.

3.5.3.1.3 The ball is raised to a certain height above the wall to be tested, and released and allowed to fall freely.

3.5.3.1.4 The height of the drop shall be equal to:

- a) 1 m for normal containers (tank and lid) and lids of reinforced containers, and
- b) 2 m for tanks of reinforced containers.

3.5.3.2 Test of the lid

3.5.3.2.1 The lid shall be subjected to a first series of three impacts on the joint of each hinge.

3.5.3.2.2 Repeat the test on each hinge or on two points in the case of a continuous hinge.

3.5.3.2.3 The lid shall then be subjected to a second series of three impact loads on the lid face. Three different points on the lid, chosen at random, shall be subjected to this series of impact loads (on central impact and two opposite angles).

3.5.3.3 Test on protrusions, if any — Three impact loadings shall be carried out on each significant protrusion (Examples: handle, return, reinforcement, gripping device, etc).

3.5.3.4 Test on upper edge of container (lid open) — Three series of impact loads shall be carried out at random at three points distributed suitably.

3.5.3.5 Test on the base — The test shall be carried out on empty container.

3.5.3.5.1 If the base is made up of parts of different types (reinforcement, overhangs, etc) five points chosen after evaluating structures on the base of the container shall be subjected to three impact loads. If the base is uniform, five points shall be chosen at random and suitably distributed.

3.5.4 Acceptance criteria — After the impact test, the container shall show neither permanent deformation nor abnormality making it unfit for use, or having an influence on its later ageing process; and its dimensional characteristics regarding handling and interchangeability shall be respected.

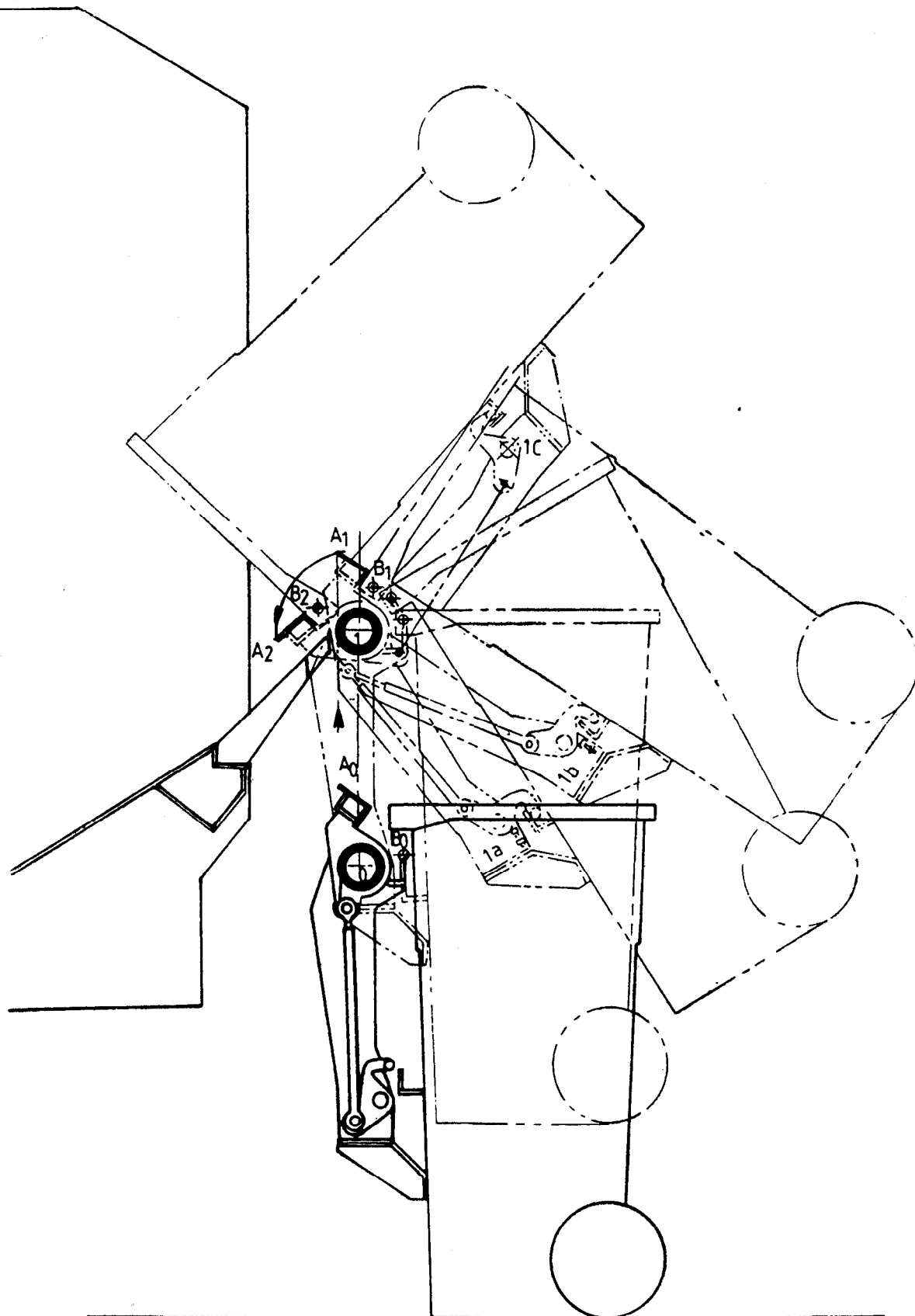


FIG. 3 COMPREHENSIVE GRIPPING SYSTEM FOR LIFTING TEST

3.6 Test 6 — Vibration Test

3.6.1 Equipment — Vibrating table.

3.6.2 Procedure

3.6.2.1 The container shall be placed in its normal working position with the wheels free to move on a vibrating table.

3.6.2.2 The duration of test and the characteristics of the table motion shall be as given below:

Container	Frequency (Hz)	Vertical Movement (mm)	Horizontal Movement (mm)	Duration (h)
Empty	5	15	0	2 (1 h lid closed) (1 h lid open)
Loaded	4	15	6	4 (2 h lid closed) (2 h lid open)

3.6.3 Acceptance criteria — After the test, the container shall show neither permanent deformation nor abnormality making it unfit for use, or having an influence on its later ageing process; and its dimensional characteristics regarding handling and interchangeability shall be respected. Castors and pivots shall be free.

3.7 Test 7 — Vertical Impact by Free Fall

3.7.1 Test on empty container

3.7.1.1 Equipment — Jip or trap door for free fall.

3.7.1.2 Procedure

3.7.1.2.1 The container shall fall freely as follows:

Containers	Height of Fall (m)
Reinforced type 'R'	1.00 ± 0.05
Normal type 'N'	0.50 ± 0.05

3.7.1.2.2 The lid shall be held in a closed position (with the help of metal strip, strings, etc).

3.7.1.2.3 Position and number of falls — Ten falls on each of the faces except on the base and the lid shall be carried out. The first four falls shall be carried out on different faces.

3.7.2 Test on loaded container — The test, carried out on a loaded container, is designed to simulate the passage of a trough, the ascent from or descent to a basement on a ramp with faulty run.

3.7.2.1 Procedure

3.7.2.1.1 Class B containers shall be suspended so that the base is parallel to the surface of impact. Differences in height between the lowest and the highest wheel shall be allowed provided they do not exceed 30 mm (The 30 mm adjustment is effected on the lowest wheel).

3.7.2.1.2 Class A containers shall be inclined so that the fall takes place on the castors. The angle of inclination relative to the vertical shall be equal to 10°.

3.7.2.1.3 The total number of falls shall be 50 (25 with the lid closed and 25 with the lid open).

3.7.2.1.4 Test conditions — The test conditions for the loaded containers in relation to their type and capacity shall be as given in Table 2.

TABLE 2 TEST CONDITIONS

Container			Test Load (kN)	Height of Fall (mm)	Number of Falls
Type		Capacity (litre)			
Class A	Normal	120	0.48	160	50
		240	0.96	160	50
		330	1.32	160	50
	Reinforced	120	1.2	160	50
		240	2.4	160	50
		330	3.3	160	50
Class B	Normal	500	2.0	140	50
		750	3.0	140	50
		1 000	4.0	140	50
	Reinforced	500	5.0	140	50
		750	7.5	140	50
		1 000	10	140	50

Note 1 — The height of 140 mm corresponds to the average height of a pavement edge.

Note 2 — The height of fall is not modified in relation to the load weight since the height of pavement edges is a fixed value.

Note 3 — The height of 160 mm takes into account the fact that some small containers have to be negotiated over steps whose average rise is 160 mm.

3.7.3 Acceptance criteria — After the test, the container shall show neither permanent deformation nor abnormality making it unfit for use, or having an influence on its later ageing process; and its dimensional characteristics regarding handling and interchangeability shall be respected. Castors and pivots shall be free.

3.8 Test 8 — Impact on Inclined Plane

3.8.1 Equipment — Inclined plane with truck.

3.8.2 Procedure

3.8.2.1 Later impact — The loaded container shall be placed on the truck (inclination of 10° relative to the horizontal) in its normal working position (see Fig. 4 for the provisions taken to avoid accidental tipping of the truck during the test).

3.8.2.2 The truck travel shall be 1 m when one face is tested and 0.5 m when one edge is tested.

3.8.2.3 The vertical faces of the container shall be numbered from 1 to 4, the face marked 1 being one of the large faces equipped with the gripping system.

3.8.2.4 Edges shall be marked 1-2, 2-3, 3-4 and 4-1.

3.8.2.5 The total number of impacts shall be 80. The impacts shall be carried out in the sequence given in Table 3.

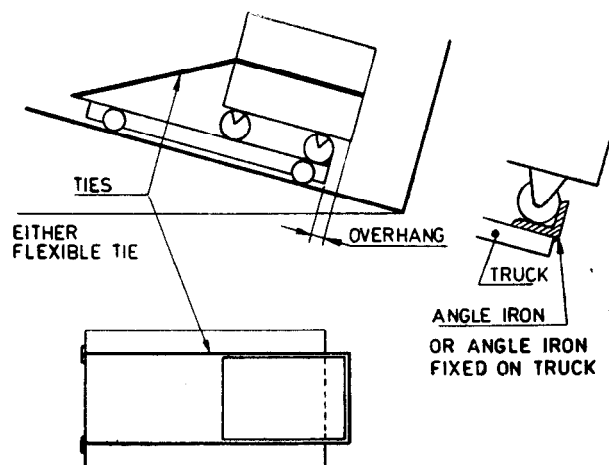


FIG. 4 PROVISIONS TAKEN TO AVOID ACCIDENTAL TIPPING OF THE TRUCK DURING LATERAL IMPACT TEST ON INCLINED PLANE

TABLE 3 SEQUENCE OF IMPACTS
(Clause 3.8.2.5)

SI No.	Impact No.	Face or Edge Tested	No. of Impacts Relative to the Position of the Lid(s)	
			Lid Closed	Lid Open
1	1 to 10	Face 1	8	2
2	11 to 20	Edge 1-2	8	2
3	21 to 30	Face 2	8	2
4	31 to 40	Edge 2-3	8	2
5	41 to 50	Face 3	8	2
6	51 to 60	Edge 3-4	8	2
7	61 to 70	Face 4	8	2
8	71 to 80	Edge 4-1	8	2

3.8.3 Acceptance criteria — After the test, the container shall show neither permanent deformation nor abnormality making it unfit for use, or having an influence on its later ageing process; and its dimensional characteristics regarding handling and interchangeability shall be respected. Castors and pivots shall be free.

3.9 Test 9 — Effectiveness of Braking Device — Class B Four Wheeled Containers

3.9.1 General — Mobile containers shall respect the same conditions of immobilization when they are placed on a slope as those of any vehicle under the same conditions.

3.9.2 Procedure

3.9.2.1 The loaded container shall be placed on a rigid flat surface inclined at 18 percent relative to the horizontal.

3.9.2.2 The longitudinal axis to the container as well as its wheels shall be parallel to the most inclined line of the inclined surface.

3.9.3 Acceptance criteria — The containers shall remain still for 10 seconds after the application of the brake.

3.10 Test 10 — Strength of Handles — Class A Containers

3.10.1 Equipment — Jip and 100 mm wide straps.

3.10.2 Procedure — The tested container shall be suspended by two straps which grip the handle(s).

3.10.3 Duration of test shall be 1 h.

3.10.4 Acceptance criteria — The handles shall remain integral with the container and shall not show any tear or rupture.

3.11 Test 11 — *Lifting of the Loaded Container*

3.11.1 Equipment — Comprehensive gripping system shown in Fig. 3.

3.11.2 Procedure

3.11.2.1 A special device shall be provided to prevent the load from escaping during lifting and tipping of the container.

3.11.2.2 The container shall be placed in its normal position.

3.11.2.3 100 motions shall be carried out.

3.11.3 Acceptance criteria — After the test, the container shall show neither permanent deformation nor abnormality making it unfit for use, or having an influence on its later ageing process; and its dimensional characteristics regarding handling and interchangeability shall be respected.

3.12 Test 12 — *Stability (static and dynamic)*

3.12.1 General

3.12.1.1 The test shall be carried out on empty and loaded containers.

3.12.1.2 The static stability test applies to both Class A and Class B containers and the dynamic stability test applies only to Class B containers.

3.12.2 Procedure

3.12.2.1 Static stability — Empty or loaded containers shall be placed on a plane inclined at 18 percent relative to the horizontal (approx 10°). Stability shall be tested in the following three positions:

- Transversal stability** — The transversal axis of the container shall be parallel to the most inclined line of the inclined plane.
- Longitudinal stability** — The longitudinal axis of the container shall be parallel to the most inclined line of the inclined plane.
- Diagonal stability** — A diagonal of the container shall be parallel to the most inclined line of the inclined plane.

3.12.2.2 Acceptance criteria — During the test, the container shall not tip.

3.12.2.3 Dynamic stability

3.12.2.3.1 The loaded container shall freely hit the edge of a footpath of the front door type (see Fig. 5) at a speed of 2 km/h, the thrust on the slope being effected along the diagonal (see Fig. 6).

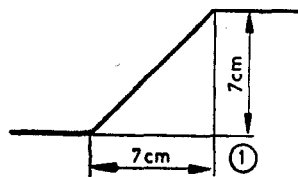


FIG. 5 EDGE OF FOOTPATH
OF FRONT DOOR TYPE

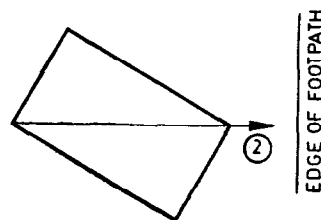


FIG. 6 DIRECTION OF THRUST

3.12.2.4 Acceptance criteria — After the test, the container shall show neither permanent deformation nor abnormality making it unfit for use, or having an influence on its later ageing process; and its dimensional characteristics regarding handling and interchangeability shall be respected.

3.13 Test 13 — *Test to Overcome Obstacles*

3.13.1 General — This test is applicable to Class B containers. The footpath edge used shall be identical to that in the dynamic stability test.

3.13.2 Procedure

3.13.2.1 The container towed at a speed of 6 km/h shall have to be negotiated over the edge of the footpath perpendicularly.

3.13.3 Acceptance criteria — After the test, the container shall show neither permanent deformation nor abnormality making it unfit for use; or having an influence on its later ageing process; and its dimensional characteristics regarding handling and interchangeability shall be respected.

3.14 Test 14 — Tensile (Towage) Test — This test is applicable to Class B containers and is identical to Test 3.

3.15 Test 15 — Salt Mist Test

3.15.1 Metal components stressed during mechanical test shall be cut away and subjected to a salt mist test for 72 h with 20 percent concentration.

3.15.2 Deterioration shall be noted after the test.

3.16 Test 16 — Noise Test

3.16.1 The level of acoustic pressure shall be measured in accordance with IS : 9876-1981 'Guide to the measurement of the airborne acoustical noise and evaluation of its effects on man'.

3.16.2 The closing and the opening of the lid during manual interventions or emptying operation of the container shall not produce a level of acoustic pressure noise exceeding that of the container itself when the latter is subjected to lifting and emptying operations [85 dB (A)].

3.16.3 The level of acoustic pressure produced by rolling and towing the containers shall remain below or at the most equal to that of the noise of average traffic [70 dB (A)].

3.17 Test 17 — inflammability Test — Determination of the Index — This test shall be carried out in accordance with IS : 3809-1979 'Fire resistance test of structures (first revision)'.

3.18 Test 18 — Test to Check Maximum Deflection — This test shall be identical to Test 1.

EXPLANATORY NOTE

The purpose of this standard is to fix mechanical and physical characteristics of suitability for the use of mobile containers for solid waste.

This standard is being issued in two parts:

Part 1 General characteristics, and

Part 2 Methods of test.

In the preparation of this standard, assistance has been derived from NF H 96-111-1981 'Mobile containers for solid waste — Test methods', issued by the Association Francaise de Normalization (AFNOR).